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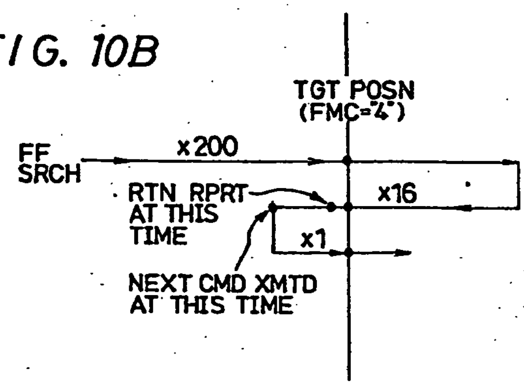
(54) **Search methods for recording media.**

(57) A method of position detection on a recording medium is performed by moving the recording medium alternately in normal and reverse directions while searching for a target position, and decreasing the transport speed of the recording medium with each change of direction. Immediately after the target position has been passed after a predetermined number of detections, a report signal of search completion is generated, thereby shortening the search time.

FIG. 10B



EP 0 323 910 A2

Description

SEARCH METHODS FOR RECORDING MEDIA

This invention relates to search methods for recording media and to apparatus and methods for recording and/or reproducing digital signals.

Data stored on a hard disc or the like of a computer can be transferred to and recorded by a data streamer or data recorder once a day, so as to protect or back up the data. For this operation, analog audio tape recorders have been used in certain cases. However, analog tape recorders have disadvantages in that they need a considerable amount of magnetic tape for recording, and they operate at a relatively low data transferring rate upon recording, so that it takes a long time to transfer and record such data information. Moreover, analog tape recorders have further problems, for example the starting point of a desired portion of the recorded data information cannot be rapidly searched for.

Thus, to overcome the above-mentioned problems, it has been proposed to utilise a helical-scan type digital audio tape recorder (DAT) using a rotary head as a data recorder. Such data recorders utilising a DAT are described in European Patent Applications Serial Nos. EP-A-0 272 130, EP-A-0 286 412, EP-A-0 297 809 and EP-A-0 300 732.

To utilise a DAT as a data recorder, data transferred from a host computer is transformed in accordance with a DAT format before recording. In the DAT format, one frame is made up of two oblique tracks formed by one rotation of two heads having different azimuth angles. 16-bit pulse code modulation (PCM) audio data, which has been interleaved, and auxiliary sub-data are recorded in this one frame area as a unit. During recording, there are formed in each track a main area for recording the PCM data and a sub-area for recording the sub-data.

The DAT has a high-speed search function. The high-speed search operation in the previously-proposed DAT is performed by the method shown in Figure 1 of the accompanying drawings.

In Figure 1, when a target position of a magnetic tape 15 on which positions signals "1", "2", "3", ... are recorded is designated, for example, as "4" in performing a search operation, a position detection signal is detected while driving the tape 15 typically at 200-times normal playback speed. When the target position "4" is detected, a stop signal is supplied, and the tape 15 passes by the target position and is then stopped. The tape 15 then travels in the reverse direction typically at 16-times normal speed, and when the target position is detected, a stop signal is supplied. In this case, the tape 15 passes by the target position in the reverse direction and is again stopped. The tape 15 is again reversed in direction and travels at 3-times the normal speed. When the target position is detected, the stop signal is supplied. The tape 15 is once again reversed and travels in the reverse direction at the normal speed. When the target position is detected and the stop signal is supplied, the tape 15 slightly passes by the target position, and is then stopped. In this case, a search end signal is generated, and the next command signal is awaited. When the command signal is supplied in this waiting state, the magnetic tape 15 travels in the opposite direction at the normal speed, and the target position "4" is accurately detected.

In the previously-proposed high-speed search operation, since the tape is kept stopped after the search end signal is generated until the next command signal is supplied, there is a time delay, thus impairing the efficiency of the search operation.

In accordance with this invention there is provided a search method for use with a recording medium on which a plurality of position signals are recorded at intervals, the method comprising the steps of:
driving the recording medium initially in one direction while detecting the recorded position signals from a position which is fixed relative to the recording medium;
reversing the driving direction of the recording medium when a predetermined recorded position signal is detected;
decreasing the speed of the recording medium until the predetermined recorded position signal is detected again;
repeating the foregoing steps a predetermined number of times so as to detect a target position on the recording medium; and
after detecting that the target position has been last passed, generating a report signal indicating that the target position has been searched.

A preferred embodiment of the present invention, to be described in greater detail hereinafter, provides a search method for a recording medium, which is capable of performing a search operation without wasting time.

The present invention also provides a search method for a recording medium in which the recording medium recorded with a position signal is alternately driven in normal and reverse directions while detecting the position signal and decreasing the travel speed each time the travel direction is switched so as to detect a target position on said recording medium, whereinafter when it is detected that the target position has been last passed, a report signal indicating that the target position has been searched is generated.

In carrying out this data search method, a target count value and a count value reproduced from the recording medium are preferably compared with each other, the direction and speed of the recording medium are controlled in accordance with the comparison output, and when the count value reproduced from the recording medium comes close to the target count value, the report signal is generated after detecting a division of the unit count signal.

The invention will now be described by way of example with reference to the accompanying drawings, throughout which like parts are referred to by like references, and in which:

Figure 1 is a schematic view showing a

previously-proposed search method;

Figure 2 is a block diagram showing an embodiment of the present invention;

Figure 3 is a schematic view showing a DAT format;

Figure 4 is a view showing a data format of a main data block;

Figure 5 is a view showing a data format of a main area for one frame;

Figures 6A and 6B are depictions of the data formats of even and odd numbered sub-code blocks, respectively;

Figures 7 and 8 are views showing data formats of packs in the sub-code block;

Figure 9 is a view showing the relationship between groups and save sets;

Figure 10A shows an example of the indications of various counts for various groups of 23 frames;

Figure 10B is an illustration showing a forward tape direction search method;

Figure 10C is an illustration showing a reverse tape direction search method; and

Figures 11A and 11B together constitute a flow chart showing a search sequence.

Figure 2 shows an arrangement in which a DAT 1 is used as a data recorder, the arrangement also including an interface bus 2, a host computer 3, and inner buses 4, 5. The DAT 1 includes a recording/reproducing section 6, a recording amplifier 7, a reproducing amplifier 8, a signal processing circuit 9, a random access memory (RAM) 10, a data controller 11, an interface board 12, a system controller 13 and a servo and motor drive circuit 14.

The system controller 13, the signal processing circuit 9 and the data controller 11 are arranged to exchange predetermined signals such as an absolute frame number AFNO, a mode instruction, a logical frame number LFNO, a data transfer instruction and the like.

Although this is not shown, the recording/reproducing section 6 is provided with a rotary head drum. A magnetic tape is wound around the drum over an angular range of about 90° and is fed by a capstan. The drum has two heads A and B having different azimuth angles. During one revolution of the drum, two oblique tracks are recorded on or reproduced from the tape.

Digital data supplied from the host computer 3 through the buses 5, 2 and 4 is input to the interface board 12, and is then subjected to predetermined signal processing in the data controller 11, the RAM 10, and the signal processing circuit 9 in accordance with instructions from the system controller 13. In this manner, conversion to the DAT format (described above) is performed. The converted signal is supplied to the recording/reproducing section 6 through the recording amplifier 7, and is recorded on the magnetic tape by the heads A and B.

The signal recorded on the magnetic tape can also be reproduced by the heads A and B. The reproduced signal is supplied to the signal processing circuit 9 through the reproducing amplifier 8. Digital data which is obtained by reconverting the reproduced signal in the signal processing circuit 9 is supplied to the host computer 3 through the data controller 11, the interface board 12 and the buses 4, 2 and 5.

In the above apparatus, the DAT format which is used on the magnetic tape is as shown in Figure 3. During one revolution of the heads A and B, two oblique tracks TA and TB are formed on a tape 15 starting from its lower side, as indicated by an arrow a.

The two tracks TA and TB constitute one frame. Each of the tracks TA and TB consists of 196 blocks, and one block consists of 288 bits. 34 blocks at each end portion serve as a sub area, and 128 central blocks serve as a main area.

Each sub area is further divided into sections. More specifically, there are provided, from the lower end of the track, a margin section, a phase lock loop (PLL) preamble section of a sub code, a first sub-code section constituted of 8 blocks, a postamble section, a gap section for a block section, a tracking (ATF) signal section, a gap section between adjacent blocks, and a PLL preamble of data. Then, after the main data section there follows a gap section between adjacent blocks, an ATF signal section, a gap section between adjacent blocks, a PLL preamble section of a sub code, a second sub-code section constituted by 8 blocks, a postamble second sub-code section, and a margin section. The other blocks are constituted by respective predetermined numbers of blocks. It should be noted that in Figure 3, the measure of the lengths of the sections is not to scale.

The main area consists of 128 data blocks. As shown in Figure 4, each block is constituted by an 8-bit synchronising (sync) signal, an 8-bit pulse code modulation identification (PCM-ID) signal W1, an 8-bit block address W2 and an 8-bit parity, and main data is stored in the following 256-bit section. The main data is 16-bit PCM data for left L and right R channels when an audio signal is processed. The 16-bit main data is interleaved in the main areas of the tracks TA and TB (one frame) together with the parity. In this case, in the main areas in one frame, about 5760 bytes of data are recorded. When the DAT is used as a data recorder, the data sent from the host computer 3 is converted into 16-bit data and is processed in the same manner as the PCM data. This data is formatted as shown in Figure 5 and is recorded in the main areas comprising one frame.

More specifically, in Figure 5, the above-mentioned 5760 bytes are divided into 1440 words (0 to 1439), each consisting of 4 bytes (32 bits). These words are divided into 16-bit (2-byte) L and R channels to correspond to the audio signal. In this format, a header portion is provided in the first word (4 bytes). Four bits near the most significant bit (MSB) of the first half byte in the L channel in this header portion serve as a format ID indicating a format of the data recorder, and the remaining 4 bits of this byte are indefinite. The remaining one byte in this L channel is used as a logical frame number (LFNO) area. Each 8-bit LFNO area provides a binary value indicating one of a series of numbers (1 to 23) of frames. The frames are organised in units or groups of 23 frames. In the R channel in the header

portion, the same data as that in the L channel is provided.

A total of 5756 bytes of a data portion is provided in the following words "1" to "1439", and data signals from the host computer 3 are sequentially stored in respective words in units of 4 bytes each.

The logical frame number LFNO will now be described. Each LFNO area indicates one of the serial numbers 1 to 23 of the frames in units of 23 frames. That is, the frame numbers 1 to 23 repeatedly appear every 23 frames.

By designating a unit numbered by such LFNOs, the divisions for each predetermined amount of data can be easily detected, and signal processing and high-speed searching can be facilitated.

The data formats in the first and second sub-code sections in the sub area will now be described. Each of the first and second sub-code sections consists of 8 sub-code blocks, and can record 2048 bits of data.

Figures 6A and 6B show, respectively, the constructions of the even-numbered sub-code blocks (EVEN blocks) and the odd-numbered sub-code blocks (ODD blocks), in each of which a synchronising signal, the areas W1 and W2 and a parity, respectively formed of eight bits, and 256 bits of sub-code data including a parity, are located in this order. The sub-code data is divided into four packs formed of 64 (8 x 8) bits (eight symbols), respectively.

As shown in Figures 6A and 6B, the contents of the areas W1 and W2 in the EVEN block are different from those in the ODD block, and the packs in the EVEN and ODD blocks are alternately numbered from "1" to "7". The eighth pack is assigned to record an error detecting code C1.

The area W1 of the EVEN block consists of a 4-bit area ID and a 4-bit data ID, and the area W2 thereof consists of an upper bit "1", a 3-bit pack ID, and a 4-bit block address. The area W1 in the ODD block consists of a 4-bit indefinite portion, and a 4-bit format ID, and the area W2 thereof consists of an upper bit "1", a 3-bit all "0" code, and a 4-bit block address.

Each of the packs "1" to "7" is divided into 8 words in units of 8 bits. Each word includes, together with a parity, various codes such as a code indicating a read-in area of a recording start portion on a tape, a code indicating a read-out area of a recording end portion, a code indicating a recording date, an absolute frame number, a logical frame number and the like.

Figure 7 shows the format of the pack "1" of the seven packs, and Figure B shows the format of the pack "2".

Referring to Figure 7, the pack "1" consists of eight 8-bit words, PC1 to PC8. The upper four bits of the word PC1 are assigned to a pack number (in this case, "0001" indicating pack "1"), and the next 2 bits are indefinite. The following lower two bits (P,M) provide a repeat ID (R-ID) associated with multiple writing of data for a plurality of units. The following words PC2 and PC3 (16 bits) are assigned to a group count GPC. The group count GPC is a value obtained by counting the number of units of 23 frames (called groups hereinafter) from the leading end of a tape.

The following words PC4 to PC7 (32 bits) are assigned to a file mark count FMC. A file mark indicates a division of a predetermined amount of data sent from the host computer. The file mark count FMC is a value obtained by counting the number of file marks from the leading end of the tape until counting of the count GPC is completed for the group of 23 frames. The word PC 8 is assigned to a parity for the words PC1 to PC7.

In Figure 8, the pack "2" consists of 8 words PC1 to PC8. The upper 4 bits of the word PC1 are assigned to a pack number (in this case, "0010" indicating the pack "2"). The words PC2 and PC3 (16 bits) are assigned to a save set mark count SSMC. Data recorded by the data recorder during one back-up operation is called a save set, and a save set mark is sent from the host computer for each save set. The save set mark count SSMC indicates a value obtained by counting the number of save set marks from the leading end of the tape until counting of the count GPC is completed for each group of 23 frames. The following words PC4 to PC7 (32 bits) are assigned to a record mark count RMC. A record mark is a mark sent from the host computer for each division of the predetermined amount of data. The record mark count RMC indicates a value obtained by counting the number of record marks from the leading end of the tape until counting of the count GPC is completed for each group of 23 frames. The word PC8 is assigned to a parity for the words PC1 to PC7.

In this embodiment, as described above, the packs "1" and "2" provide four count values GPC, FMC, SSMC, and RMC respectively indicating divisions of data. In other words, these count values represent four types of units. These units are not particularly associated with data lengths (recording lengths on a tape), and have predetermined independent lengths. The counts FMC, SSMC, and RMC are represented in association with the count GPC.

Figure 9 shows the relationship between the counts GPC and SSMC. The number of save set marks from the leading end of the tape until each time when a group of 23 frames is completed is recorded as the count SSMC in each of the 23 frames constituting the group including the timing. In the case of Figure 9, when the counting of the group GPC 1 is completed, since seven save set marks are counted, SSMC 7 is recorded in each of the 23 frames of the group of GPC 1. The same set of SSMC 8 extends over two groups of GPC 2 and GPC 3. Therefore, counts SSMC 8 are recorded in each of the 46 frames of these groups. The relationships between the other counts FMC and RMC and the count GPC are also determined in the same manner as in Figure 9. Figure 10A shows examples of the indications of the counts GPC, FMC, SSMC, and RMC for the respective groups.

Therefore, the above-mentioned counts GPC, FMC, SSMC, and RMC can be selectively detected, so that a high-speed search operation can be performed effectively.

A detailed description of the method of the

high-speed search operation carried out by the system controller 13 will now be given with reference to Figures 10B, 10C, 11A and 11B. The target position is given as FMC = 4, and in order to detect the target position, the count GPC is used firstly to detect a boundary point between GPC8 and GPC9.

The high-speed search operation includes a fast forward (FF) search mode as shown in Figure 10B in which the search operation is performed while fast-forwarding the tape typically at 200-times normal playback speed in a normal or forward (FWD) direction. After the target position (TGT POSN) is detected, a rewind (REW) search mode ensues in which the search operation is performed while rewinding the tape in the reverse (REW) direction typically at 16-times normal speed. Shortly after passing back over the target position, a report is returned to the computer that the target position has been detected. In this example, the computer instructs the DAT to forward the tape at normal speed.

Figure 10C shows the case in which a REW search mode is executed. The count FMC = 4 is detected while rewinding the tape at 200-times normal speed. The rewinding operation is performed until it is detected that the tape has passed by the target position. Thereafter, a stop signal is sent to the tape drive system as well as a signal for driving the tape at 16-times normal speed in the forward direction. Thus, the tape has passed by the target position and stopped, and is then reversed to travel at 16-times normal forward speed while detecting the FMC. The 16-times normal speed operation is continued until it is again determined that the tape has passed by the target position. Then the tape travel direction is reversed and the tape travels at 3-times normal reverse speed until it is determined that the tape has passed by the target position. The host computer is informed by the DAT through the bus line that the target position has been detected. After a 200-msec standby time has passed, the next command signal is awaited. When the next command signal is received, the FMC is detected while feeding the tape at the normal speed to detect the target position "4".

Figures 11A and 11B are a flow chart of the steps taken by the system controller when the FF and REW search modes are executed. A reference symbol tp indicates a target position represented by the FMC, and a symbol pp represents a present position on the tape represented by the FMC. A reference symbol GPC1 denotes a present GPC, and GPC2 represents an immediately preceding GPC. Therefore, during transport of the tape, the present GPC1 serves as the GPC2 when the next GPC1 is detected.

In Figures 10B and 11A, after a high-speed search routine is started in a step (1), it is checked whether tp > pp in a step (2), namely whether the present position is located before or after the target position. If tp > pp, then the present position is located before the target position, and the FF search mode is executed in a step (3) and in subsequent steps. If tp ≦ pp, then the present position is located after the target position, and the REW search mode is executed in a step (24) (Figure 11B) and in subsequent steps.

In the FF search mode, the count FMC is detected while fast-forwarding the tape at 200-times normal speed. The fast-forwarding operation is performed until it is detected in a step (4) that tp ≦ pp, indicating that the tape has arrived at the target position or has passed by the target position. If the determination is YES in the step (4), a stop signal is sent to the tape drive system in a step (5) as well as a signal for driving the tape at 16-times normal speed in the opposite direction. Thus, the tape has passed by the target position and stopped, and is then reversed, so that it travels at 16-times normal speed while detecting the FMC. In a step (6), as the tape is travelling, the GPCs are detected and sequentially set to be GPC1 and GPC2. The 16-times normal speed travel is performed until tp > pp in a step (7), namely until it is determined that the target position has been passed again. If the determination is YES in the step (7), it is checked in a step (8) if GPC2 - GPC1 = 1. If GPC2 - GPC1 = 1 immediately after tp > pp is established in the step (8), then GPC2 = 9 and GPC1 = 8 (see Figure 10A), and it is assumed that the tape has reached the target position. In a step (9), the host computer is informed by the sending of a "Good Report" signal through the bus line that the target position has been detected. After a 60-msec standby time has passed in a step (10), the next command signal is awaited in a step (11). When the next command signal is received in the step (11), an operation is performed in accordance with the command signal in a step (12). In this operation, the FMC is detected while forwarding the tape at normal speed to search the target position "4". If no command signal is supplied in the step (11), the tape is stopped in a step (13), and the routine is ended in a step (14).

If GPC2 - GPC1 ≠ 1 is established in the step (8) due to dropout of data or the like, the flow advances to a step (15) to forward the tape, and the GPC is detected in a step (16). The step (16) is repeated until tp ≧ pp in a step (17), namely until the tape has passed by the target position again. If tp ≧ pp is established, it is checked in a step (18) if GPC1 - GPC2 = 1. If the determination is YES in the step (18), it is determined that the target position is detected, and the host computer is informed of this fact in a step (19). In a step (20), the tape direction is reversed, and after 600 msec have passed, the flow advances to a step (11). If GPC1 - GPC2 ≠ 1 is established in the step (18), an error report is provided in a step (21), the tape is stopped in a step (22), and the routine is ended in a step (23).

If the determination is NO in the step (2), the REW search mode is executed (Figure 11B). In the step (24), the count FMC is detected while rewinding the tape at 200-times normal speed. The rewinding operation is performed until tp > pp is established in a step (25) to determine that the tape has passed by the target position. If the determination is YES in the step (25), a stop signal is sent to the tape drive system in a step (26) as well as a signal for driving the tape at 16-times normal speed in the opposite direction. Thus, the tape has passed by the target position and stopped, and is then reversed to travel

at 16-times normal speed while detecting the FMC. The 16-times normal speed operation is continued until tp < pp in a step (27), that is, until it is again determined that the tape has passed by the target position. If the determination YES is obtained in the step (27), the tape travel direction is reversed in a step (28), and the tape travels at 3-times normal speed. In a step (29), the GPCS are detected and sequentially set to be GPC1 and GPC2. The 3-times normal speed operation is continued until tp > pp is established in a step (30), namely until it is determined that the tape has passed by the target position. If the determination is YES in the step (30), it is checked in a step (31) if GPC2 - GPC1 = 1. If GPC2 - GPC1 = 1 in the step (31) immediately after tp > pp is established in the step (30), then GPC2 = 9 and GPC1 = 8 and it is assumed that the target position has been reached. In a step (32), the host computer is informed by the sending of a "Good Report" signal through the bus line that the target position has been detected. After a 200-msec standby time has passed in a step (33), the next command signal is awaited in a step (34). If the next command signal is received, an operation corresponding to the command signal is executed in a step (35). In this operation, the FMC is detected while driving the tape at normal speed to detect the target position "FMC = 4". If no command signal is received in the step (34), the tape is stopped in a step (36), and the routine is ended in a step (37).

If GPC2 - GPC1 ≠ 1 is established in the step (31) due to dropout of data or the like, the flow enters the routine after the step (15), and the operation described above with reference to Figure 11A is executed.

As described above, immediately after it has been determined that the target position is detected in the step (8) in the FF search mode or in the step (31) in the REW search mode, a "good report" is transmitted to the host computer in the steps (9) and (32) so that the next command can be received early while the tape is being driven. Therefore, no time is wasted and the search time can be shortened. In this embodiment, the counts GPC and FMC are used as position signals of the recording medium. However, the search operation can alternatively be performed using the above-mentioned counts SSMC and RMC, as a matter of course.

In summary, according to the previously-proposed data search method illustrated in Figure 1, if a target position is set, for example, FMC = 4, then during the search after the tape has been driven at fast forward, fast rewind, forward, rewind, and so on, and then stopped at the target position FMC = 4, a search end signal is transmitted. This search method requires two time periods, namely a long period of time until the search end and also a time period waiting for the next operation command. In other words, there are required a time during which the tape is stopped, and also a rising-up time when the tape is stopped and then accelerated to its predetermined speed.

On the other hand, according to this embodiment of the present invention, when the target position FMC = 4 is searched for, before the tape is stopped at the target position, a Good Report signal indicating that the target position has been detected is supplied to the host computer. That is, in practice, in the high speed search mode, the target position FMC = 4 is detected and the speed is changed to 16- times normal speed.

When the boundary of the group including FMC = 4 is detected by comparing the difference of two successive group counts with one (for example "GPC2 - GPC1 = 1"), the Good Report signal is fed to the host computer. Thus, the next command from the host computer can be responded to without stopping the tape. A high speed search therefore becomes possible.

Claims

1. A search method for use with a recording medium (15) on which a plurality of position signals (GPC) are recorded at intervals, the method comprising the steps of:
driving the recording medium (15) initially in one direction while detecting the recorded position signals (GPC) from a position which is fixed relative to the recording medium (15);
reversing the driving direction of the recording medium (15) when a predetermined recorded position signal is detected;
decreasing the speed of the recording medium (15) until the predetermined recorded position signal is detected again;
repeating the foregoing steps a predetermined number of times so as to detect a target position on the recording medium (15); and
after detecting that the target position has been last passed, generating a report signal indicating that the target position has been searched.

2. A search method according to claim 1, wherein data is recorded in a plurality of units on the recording medium (15) and wherein main data is recorded in a first area in every unit on the recording medium, and a unit count signal and other count signals are recorded in a second area in every unit.

3. A search method according to claim 2, wherein a digital audio tape recorder (1) is used in performing the search, the first area is a pulse code modulation area and the second area is a sub-code area.

4. A search method according to claim 1, claim 2 or claim 3, wherein a target count value and a unit count value reproduced from the recording medium (15) are compared with each other, the direction and the speed of the recording medium are controlled in accordance with the comparison output, and when the count value reproduced from the recording medium becomes close to the target count value, the report signal is generated after detecting a division of the unit count signal.

5. Apparatus for searching a recording medium (15) on which a plurality of position

signals (GPC) are recorded at intervals, the apparatus being operable by a method according to any one of the preceding claims.

FIG. 1

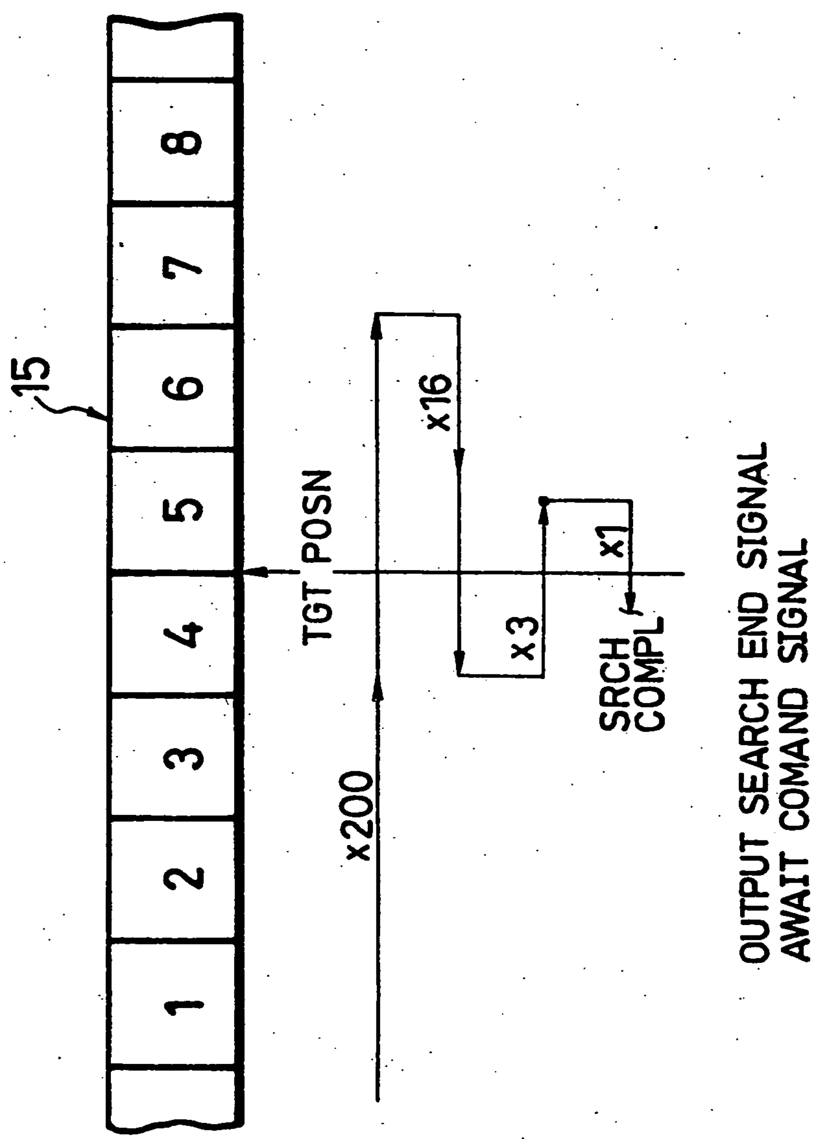
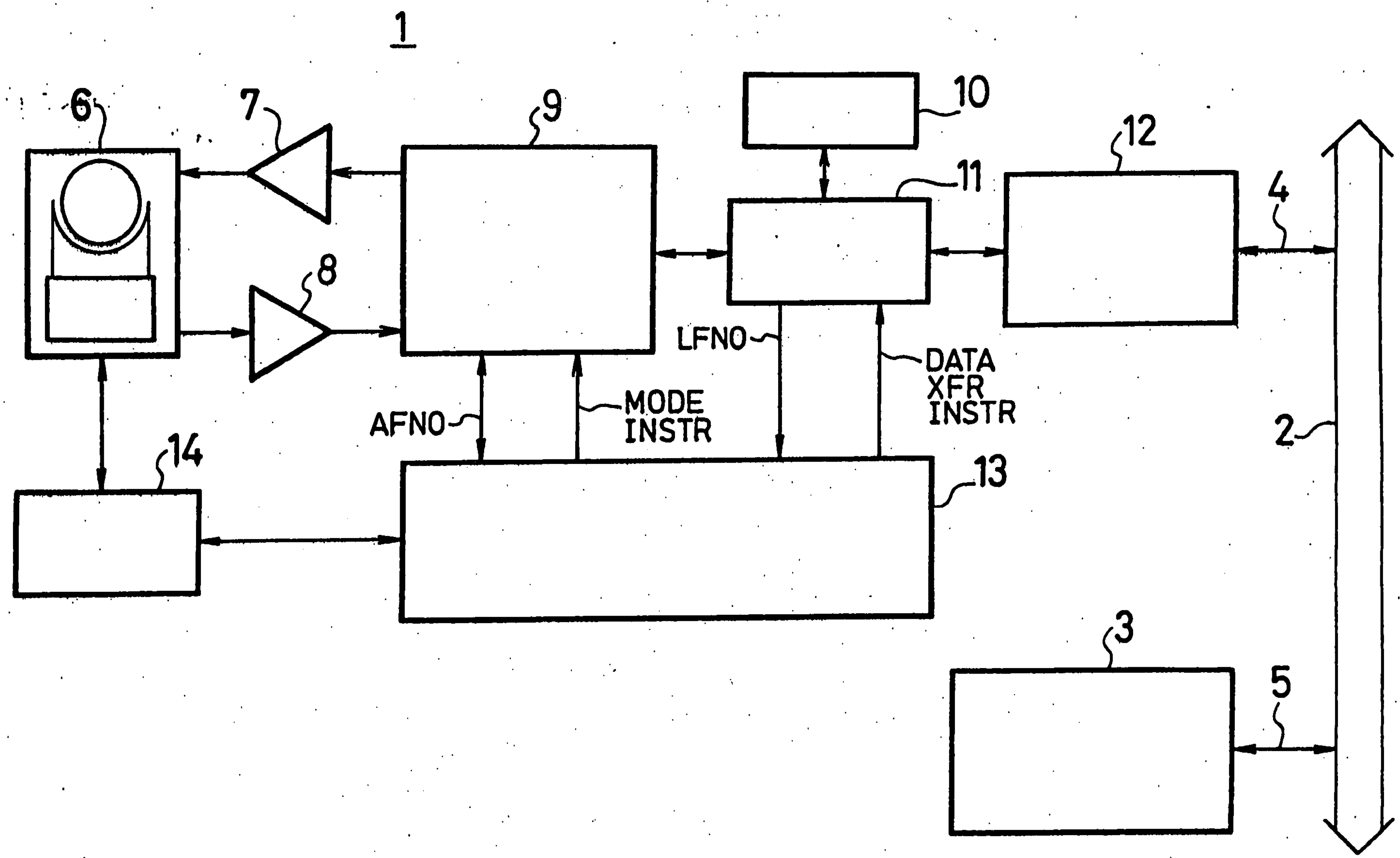
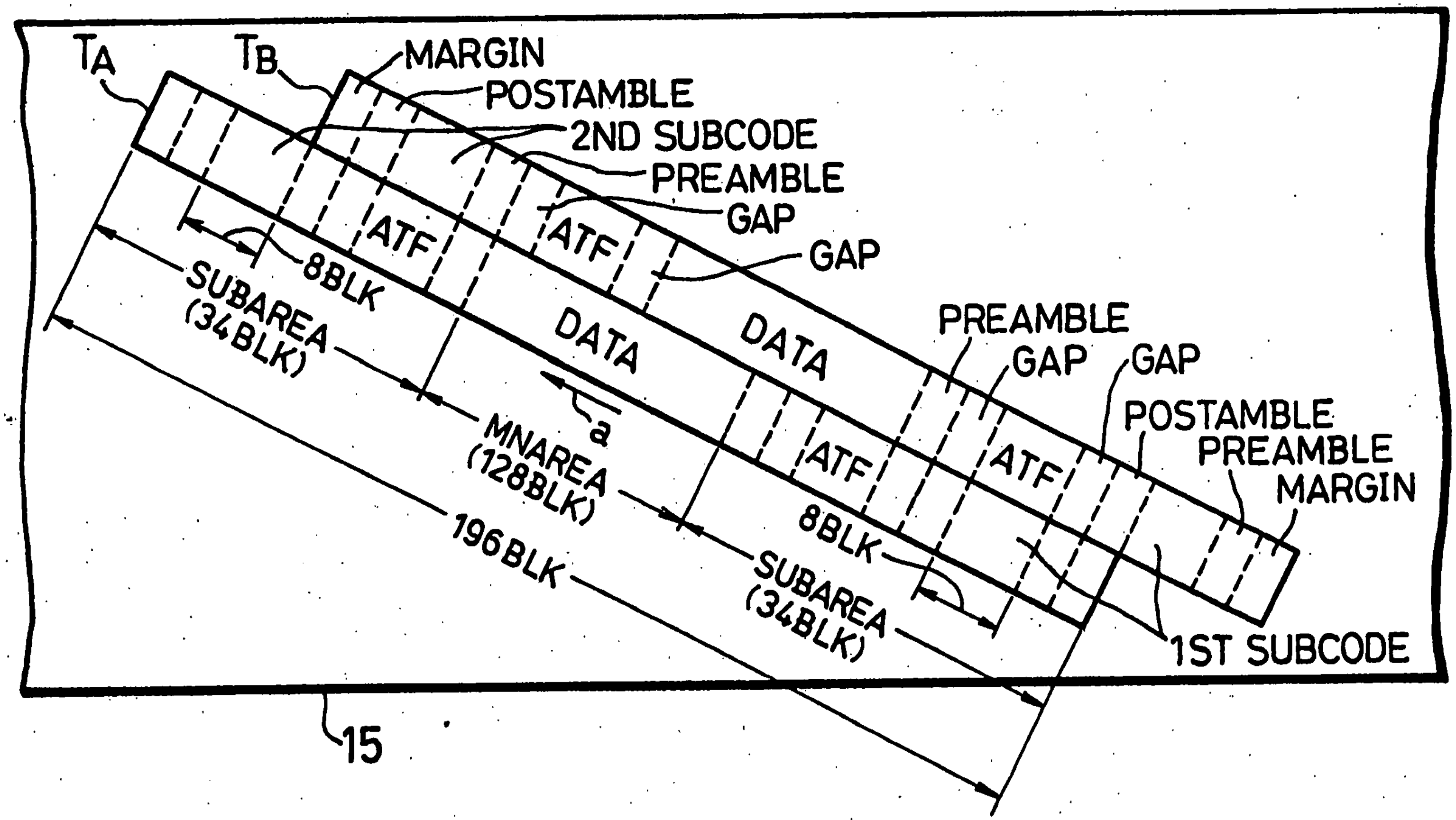

15
1
2
3
4
5
6
7
8
TGT POSN
x200
x16
x3
x1
SRCH COMPL
OUTPUT SEARCH END SIGNAL
AWAIT COMAND SIGNAL

FIG. 2




TA
TB
MARGIN
POSTAMBLE
2ND SUBCODE
PREAMBLE
GAP
GAP
ATF
ATF
8BLK
SUBAREA (34BLK)
DATA
DATA
a
MNAREA (128BLK)
196BLK
PREAMBLE
GAP
GAP
ATF
ATF
POSTAMBLE
PREAMBLE
MARGIN
8BLK
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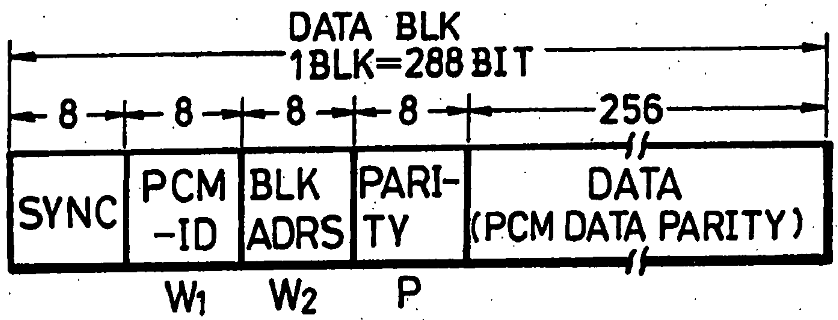
1ST SUBCODE
15

FIG. 3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8
8
8
8
256
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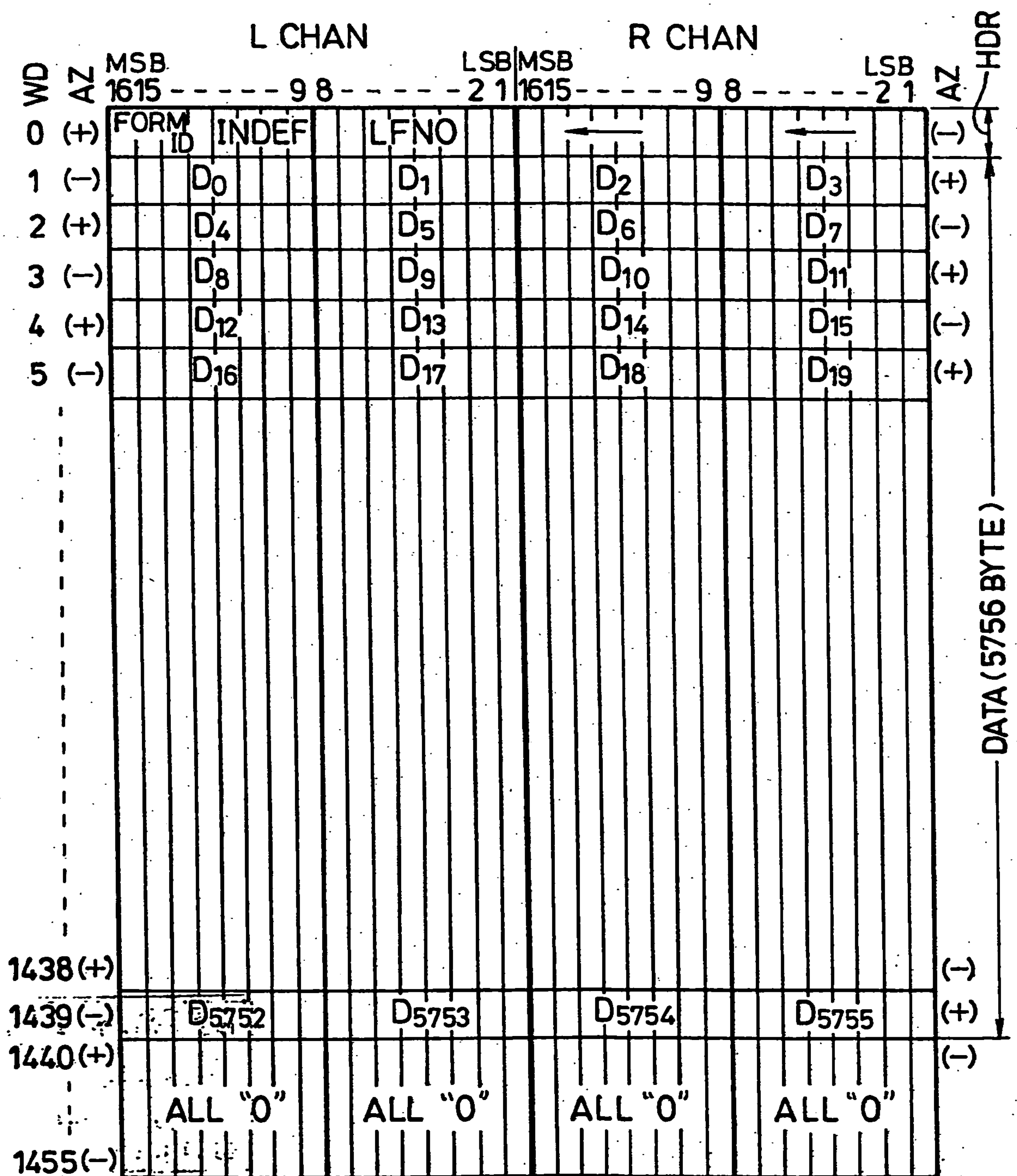
PARI-TY
DATA (PCM DATA PARITY)
W1
W2
P

FIG. 4

FIG. 5


L CHAN
R CHAN
MSB
LSB
16 15 - - - - - 9 8 - - - - - - 2 1
WD
AZ
HDR
FORM ID
INDEF
LFNO
D0 D1 D2 D3
D4 D5 D6 D7
D8 D9 D10 D11
D12 D13 D14 D15
D16 D17 D18 D19
D5752 D5753 D5754 D5755
ALL "0"
DATA (5756 BYTE)
0 (+)
1 (−)
2 (+)
3 (−)
4 (+)
5 (−)
1438 (+)
1439 (−)
1440 (+)
1455 (−)

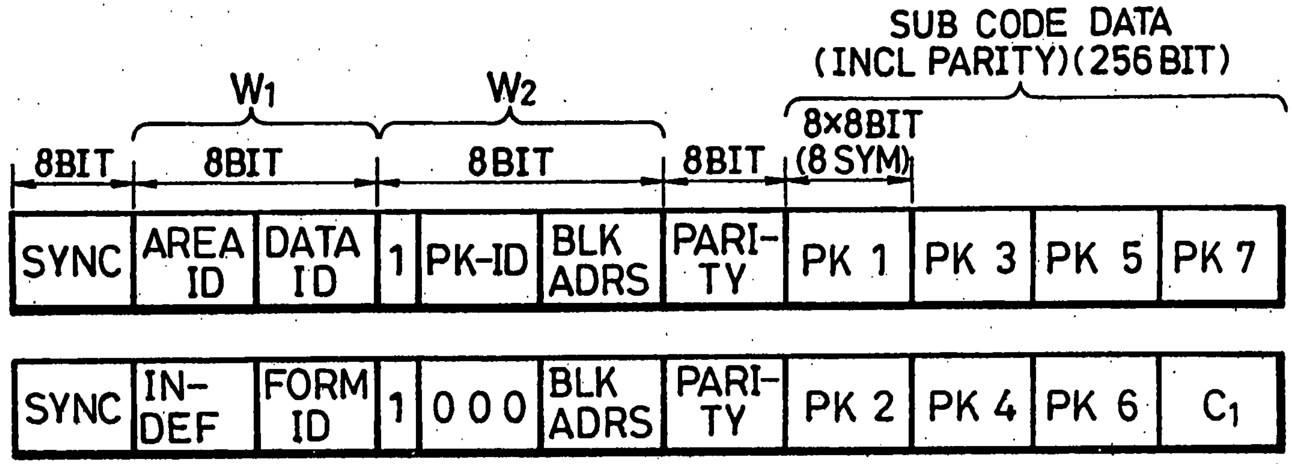


FIG. 6A EVEN BLK

FIG. 6B ODD BLK

FIG. 7

	MSB					LSB
PC 1	0	0	0	1	INDEF	R-ID P M
PC 2	GPC (GROUP COUNT) (MSB)					
PC 3	GPC (GROUP COUNT) (LSB)					
PC 4	FMC (FILE MARK COUNT) (MSB)					
PC 5	FMC (FILE MARK COUNT)					
PC 6	FMC (FILE MARK COUNT)					
PC 7	FMC (FILE MARK COUNT) (LSB)					
PC 8	PARITY					

FIG. 8

	MSB	LSB
PC 1	0 0 1 0	T. B.O.
PC 2	SSMC(SAVE SET MARK COUNT)(MSB)	
PC 3	SSMC (SAVE SET MARK COUNT)(LSB)	
PC 4	RMC(RECORD MARK COUNT)(MSB)	
PC 5	RMC(RECORD MARK COUNT)	
PC 6	RMC(RECORD MARK COUNT)	
PC 7	RMC(RECORD MARK COUNT)(LSB)	
PC 8	PARITY	

FIG. 9

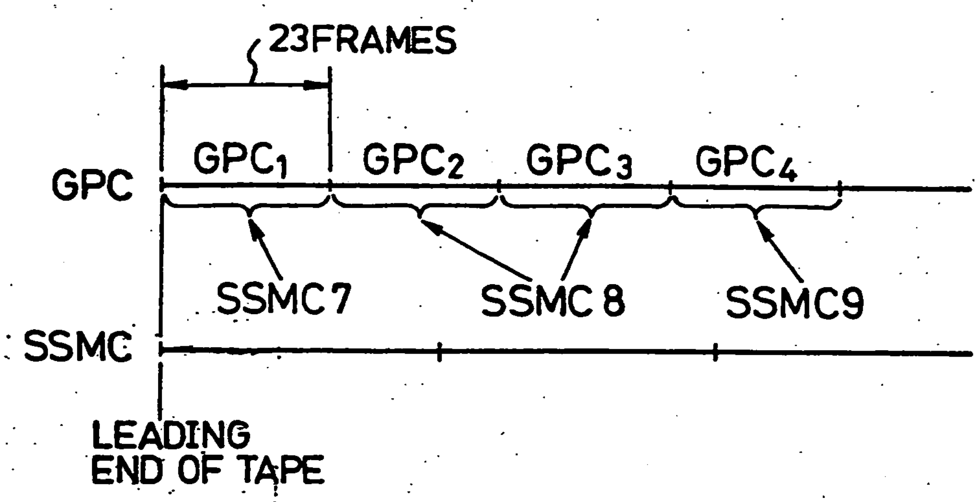


FIG. 10A

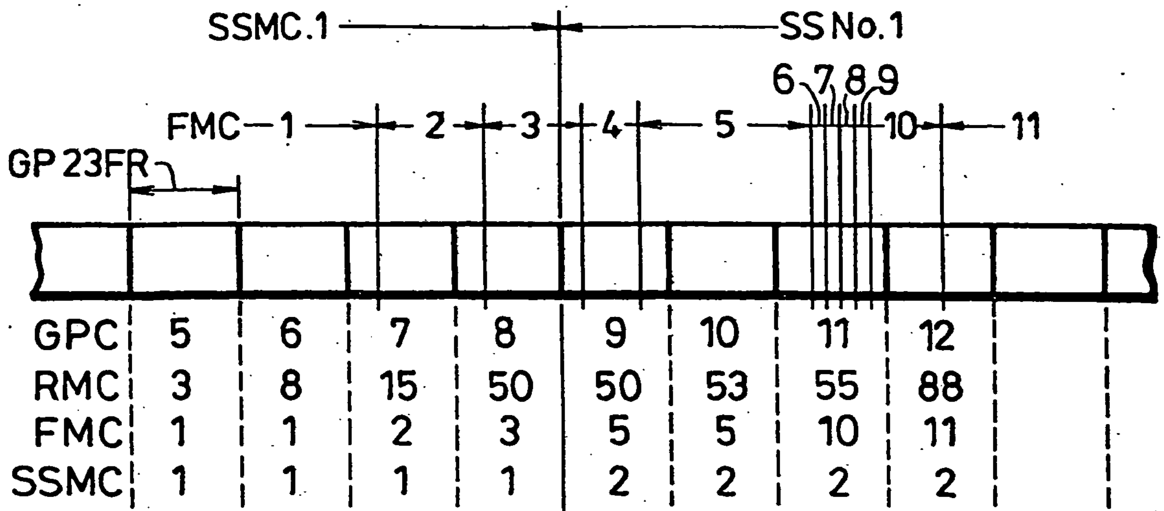


FIG. 10B

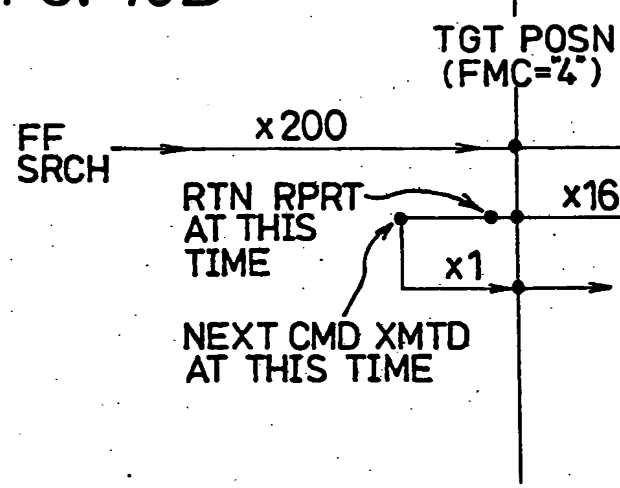
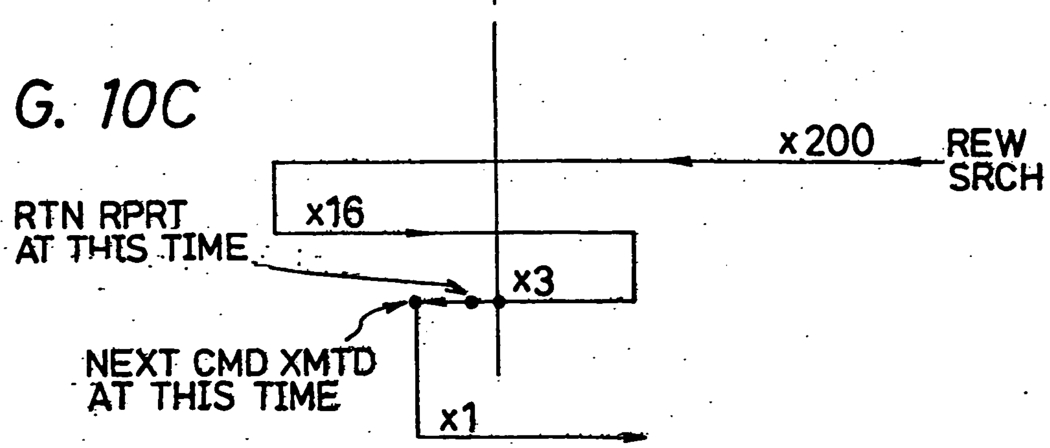


FIG. 10C



F I G. 11A

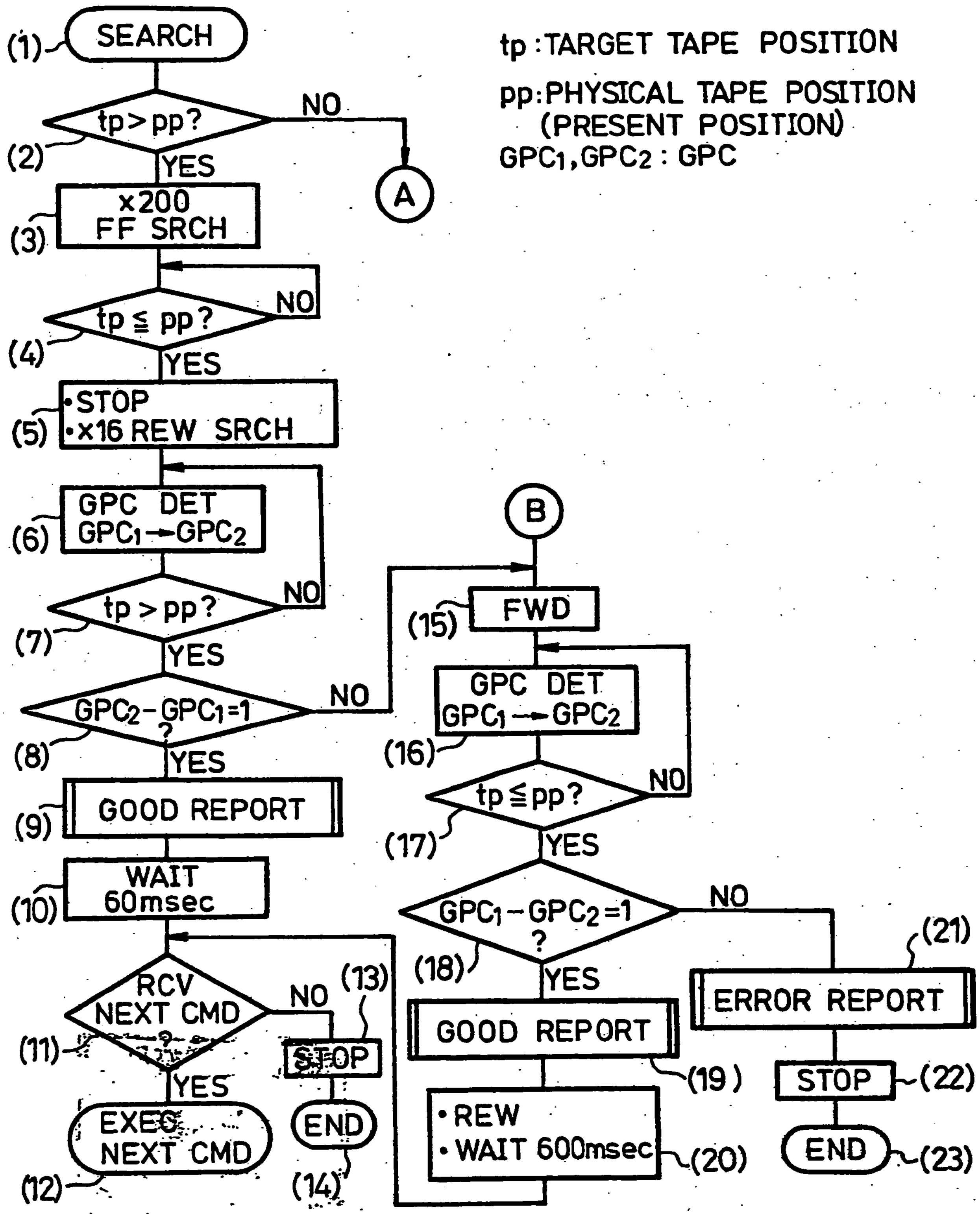
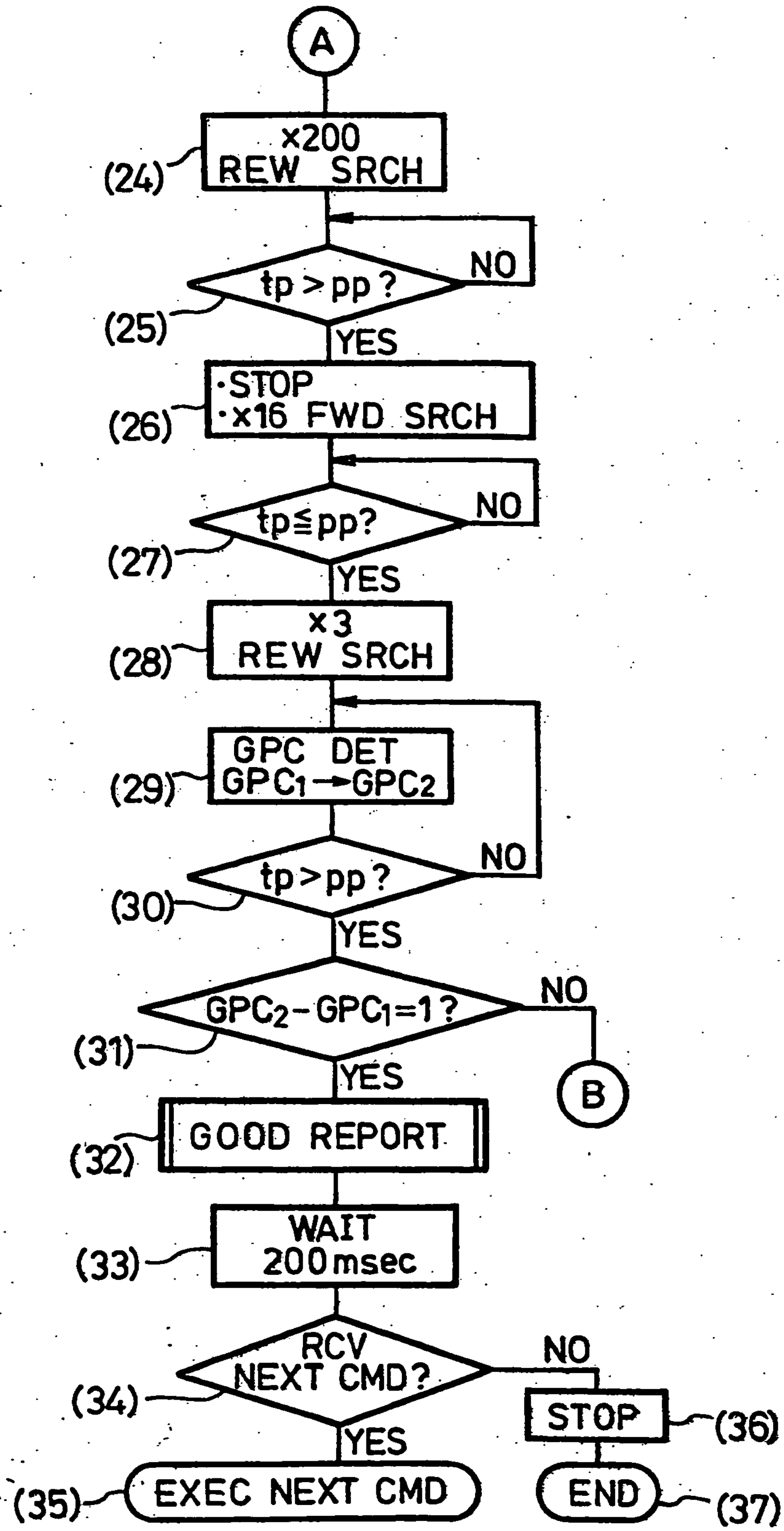

tp : TARGET TAPE POSITION
pp: PHYSICAL TAPE POSITION
(PRESENT POSITION)
GPC1, GPC2 : GPC
(1) SEARCH
(2) tp > pp?
NO
YES
A
(3) x200 FF SRCH
(4) tp ≦ pp?
NO
YES
(5) •STOP •x16 REW SRCH
(6) GPC DET GPC1→GPC2
(7) tp > pp?
NO
YES
(8) GPC2-GPC1=1 ?
NO
YES
(9) GOOD REPORT
(10) WAIT 60msec
(11) RCV NEXT CMD ?
NO
YES
(12) EXEC NEXT CMD
(13) STOP
(14) END
B
(15) FWD
(16) GPC DET GPC1→GPC2
(17) tp ≦ pp?
NO
YES
(18) GPC1-GPC2=1 ?
NO
YES
(19) GOOD REPORT
(20) • REW • WAIT 600msec
(21) ERROR REPORT
(22) STOP
(23) END

FIG. 11B


A
×200
REW SRCH
(24)
tp > pp ?
NO
(25)
YES
·STOP
·×16 FWD SRCH
(26)
tp≦pp?
NO
(27)
YES
×3
REW SRCH
(28)
GPC DET
GPC1→GPC2
(29)
tp > pp ?
NO
(30)
YES
GPC2−GPC1=1 ?
NO
(31)
B
YES
GOOD REPORT
(32)
WAIT
200 msec
(33)
RCV
NEXT CMD?
NO
(34)
YES
STOP
(36)
EXEC NEXT CMD
(35)
END
(37)